Amendment and Response
Applicant: John Wade et al.
Serial No.: 10/788,808
Filed: February 27, 2004
Docket No.: 200208190-1
Title: WIDE ARRAY FLUID EJECTION DEVICE

IN THE CLAIMS

Please cancel claims 7 and 22 without prejudice.

Please amend claims 1, 2, 8-10, 12, 13, 15, 17, 18, and 27 as follows:

1.   (Currently Amended) A fluid ejection device comprising:

a first shift register including a first set of N memory elements serially receiving a series of fire enable values, each fire enable value including one of an enabling value or a disabling value;

a second shift register including a second set of N memory elements serially receiving N image data sub-blocks of an image data block, each image data sub-block including one of an enabling value or a disabling value;

a third shift register including a third set of N memory elements receiving in parallel the N image data sub-blocks from the second set of N memory elements of the second shift register and holding the N image data sub-blocks; and

N fluid ejecting elements each receiving the fire enable value from a corresponding one of the first set of N memory elements of the first shift register and the image data sub-block from a corresponding one of the third set of N memory elements of the third shift register, wherein one of the fluid ejecting elements is enabled to eject a fluid when the fire enable value and the image data sub-block each are the enabling value.

2.   (Currently Amended) The fluid ejection device of claim 1, wherein the first set of N memory elements of the first shift register and each of the N fluid ejecting elements are formed on a thin-film structure formed on a substrate including a non-conductive material selected from a group consisting of an oxide formed on a metal, a carbon composite material, a ceramic material, and glass.

3.   (Original) The fluid ejection device of claim 1, wherein the N fluid ejecting elements are configured as a row that extends substantially for a width of a page of print media.

4.   (Cancelled)

2

Amendment and Response
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5.   (Previously Presented) The fluid ejection device of claim 1, wherein the image data block comprises a row of image data and each image data sub-block comprises a bit of image data.

6.   (Cancelled)

7.   (Cancelled)

8.   (Currently Amended) The fluid ejection device of claim 1, wherein the third set of N memory elements of the third shift register is configured to receive the image data block from the second set of N memory elements of the second shift register in response to a load enable signal.

9.   (Currently Amended) The fluid ejection device of claim 1, wherein after the third set of N memory elements of the third shift register receives the N image data sub-blocks from the second set of N memory elements of the second shift register, the second set of N memory elements of the second shift register is configured to serially receive and store N image data sub-blocks of a next image data block.

10.   (Currently Amended) The fluid ejection device of claim 1, wherein each of the N fluid ejecting elements is configured to receive upon each cycle of a clock the image data sub-block from the corresponding one of the third set of N memory elements of the third shift register.

11.   (Previously Presented) The fluid ejection device of claim 1, wherein the one of the fluid ejecting elements is not enabled to eject the fluid when one of the fire enable value or the image data sub-block is the disabling value.

12.   (Currently Amended) The fluid ejection device of claim 1, wherein the N fluid ejecting elements are configured to print a block of image data in a print cycle, wherein the

3

Amendment and Response
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first set of N memory elements of the first shift register is configured to serially receive in the print cycle a series of fire enable values representative of a fire enable pulse, and wherein the first set of N memory elements of the first shift register receives a fire enable value upon each cycle of the clock, with a first fire enable value of the series being received upon a first clock cycle of the print cycle and a last fire enable value of the series being received upon a last clock cycle of the print cycle.

13.   (Currently Amended) The fluid ejection device of claim 12, wherein a first X fire enable values of the series received during a first X clock cycles of the print cycle are enabling values and a remaining N fire enable values of the series received during a remaining N clock cycles of the print cycle are disabling values such that the enabling values propagate through the first set of N memory elements of the first shift register in a print cycle, wherein at an end of the print cycle each of the N memory elements of the first set of N memory elements of the first shift register is storing the disabling value.

14.   (Original) The fluid ejection device of claim 13, wherein a product of X multiplied by a duration of the clock cycle substantially equals an enable pulse duration.

15.   (Currently Amended) The fluid ejection device of claim 1, wherein each of the N fluid ejecting elements comprises:
     a logic element configured to receive the fire enable value from the corresponding one of the first set of N memory elements of the first shift register and the image data sub-block from the corresponding one of the third set of N memory elements of the third shift register, and to provide a power switch control signal having a first state when the fire enable value and the image data sub-block each are the enabling value;
     a heater resistor having a first terminal connectable to a power source and a second terminal; and
     a switch coupled between the second terminal of the heater resistor and ground, the switch configured to receive the power switch control signal and connect the second terminal of the heater resistor to ground when the power switch control signal has the first state.

4

16.   (Original) The fluid ejection device of claim 15, wherein the switch comprises:

a field effect transistor having a gate coupled to the logic element, a drain coupled to the second terminal of the heater resistor, and a source coupled to ground.

17.   (Currently Amended) The fluid ejection device of claim 15, wherein the logic element comprises:

an AND-gate having a first input coupled to the corresponding one of the first set of N memory elements of the first shift register, a second input coupled to the corresponding one of the third set of N memory elements of the third shift register, and an output providing the power switch control signal.

18.   (Currently Amended) A fluid ejection device comprising:

a fire enable shift register including a series of N memory elements configured to serially receive and serially transfer a series of fire enable values through the series of N memory elements;

a data input shift register including a first set of N memory elements configured to serially receive N image data bits of a row of image data;

a data hold shift register including a second set of N memory elements configured to receive in parallel the N image data bits from the first set of N memory elements and hold the N image data bits; and

N fluid ejecting elements each coupled to and configured to receive one of the fire enable values from a different one of the series of N memory elements, and coupled to and configured to receive one of the image data bits from a different one of the second set of N memory elements, wherein each fluid ejecting element is enabled to eject a fluid when the one of the fire enable values and the one of the image data bits each are an enabling value.

19.   (Original) The fluid ejection device of claim 18, wherein the series of N memory elements and each of the N fluid ejecting elements are formed on a thin-film structure formed on a substrate including a non-conductive material selected from a group consisting of an oxide formed on a metal, a carbon composite material, a ceramic material, and glass.

5

Amendment and Response
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20.   (Cancelled)

21.   (Cancelled)

22.   (Cancelled)

23.   (Previously Presented) The fluid ejection device of claim 18, wherein each of the N memory elements of the second set of N memory elements corresponds to a different one of the N memory elements of the first set of N memory elements, wherein the second set of N memory elements is configured to receive a present row of image data from the first set of N memory elements in response to a load enable signal, and wherein the first set of N memory elements is configured to serially receive a next row of image data after providing the present row of image data to the second set of N memory elements.

24.   (Previously Presented) The fluid ejection device of claim 18, wherein each of the N fluid ejecting elements corresponds to a different one of the N memory elements of the second set of N memory elements and is configured to receive upon each cycle of a clock the image data bit from a corresponding one of the N memory elements, wherein the fluid ejecting element does not eject the fluid when either the one of the fire enable values or the image data bit is a disabling value.

25.   (Previously Presented) The fluid ejection device of claim 18, wherein the N fluid ejecting elements are configured to print the row of image data in a print cycle.

26.   (Previously Presented) The fluid ejection device of claim 25, wherein the series of N memory elements is configured to serially receive during the print cycle a fire enable pulse comprising a series of the fire enable values, wherein the series of N memory elements receives one fire enable value of the series upon each cycle of the clock.

27.   (Currently Amended) A method of enabling N fluid ejecting elements of a fluid ejection device, the method comprising:

serially receiving image data values in each of N memory elements of ~~an image data input register~~ a data input shift register, each memory element of ~~the image data input register~~ the data input shift register corresponding to a different one of N memory elements of ~~an image data hold register~~ a data hold shift register;

parallel shifting the image data values from the N memory elements of ~~the image data input register~~ the data input shift register to the N memory elements of ~~the image data hold register~~ the data hold shift register and holding the image data values in the N memory elements of ~~the image data hold register~~ the data hold shift register, each memory element of ~~the image data hold register~~ the data hold shift register corresponding to a different one of the N fluid ejecting elements, each image data value being one of an enabling value or a disabling value;

serially receiving fire enable values in each of N memory elements of a fire enable shift register, each memory element of the fire enable shift register corresponding to a different one of the N fluid ejecting elements, each fire enable value being one of an enabling value or a disabling value;

updating the fire enable value in each of the N memory elements of the fire enable shift register with a fire enable value from an adjacent memory element upon each cycle of a clock; and

upon each cycle of the clock, providing to each of the N fluid ejecting elements the fire enable value from the corresponding memory element of the fire enable shift register and the image data value from the corresponding memory element of ~~the image data hold register~~ the data hold shift register, wherein a fluid ejecting element is enabled to eject a drop of fluid when the fire enable value and the image data value each are the enabling value.

28.   (Cancelled)

29.   (Cancelled)

30.   (Original) The method of claim 27, further comprising:

receiving serially in a print cycle at the fire enable shift register a series of fire enable values representative of a fire enable pulse, wherein the fire enable shift register receives a

fire enable value upon each clock cycle of the print cycle with a first enable value of the series being received upon a first clock cycle of the print cycle and a last fire enable value of the series being received upon a last clock cycle of the print cycle.

31.   (Previously Presented) The method of claim 30, further comprising:

a first X fire enable values of the series being enabling values during a first X clock cycles of the print cycle and a remaining N fire enable values of the series having a disabling value during a remaining N clock cycles of the print cycle such that the first X fire enable values being enabling values propagate through the N memory elements of the fire enable shift register in a print cycle thereby sequentially enabling each of the N fluid ejecting elements to eject a drop of fluid for a duration substantially equal to a product of X multiplied by a duration of a clock cycle.

32-43. (Cancelled)

8